

ATTACHMENT 2-A
UNITED STATES EMBASSY IN BANGLADESH
BARIDHARA, DHAKA, BANGLADESH.

TENDER DOCUMENT
FOR
INSTALLATION AND COMMISSION OF WATER WELLS AT
CHANCERY & ANNEX COMPOUND
DHAKA, BANGLADESH.

ATTACHMENT 2-A
(CHANCERY COMPOUND)

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**STATEMENT OF WORK FOR INSTALLTION AND COMMISSION OF WATER
WELLS AT CHENCHERY AND ANNEX COMPOUND
DHAKA, BANGLADESH.**

The United States department of state, Office of overseas Building Operations (OBO) propose to construct two new deep tube water wells at the Embassy in Dhaka, Bangladesh. This statement of work and all attachments is the basis for solicitation of proposal for the construction of the two required water wells.

1.0 GENERAL

1.1 SCOPE

A. Chancery well

One of the deep tube water wells will be drilled inside the Chancery compound. The Chancery compound is located at the Southwest corner of the intersection of Madani Avenue and Park Road in Dhaka. This water well shall be used to support the future water needs of the Chancery and surrounding building. Exact location of the proposed well site can be found in the attached plan drawings (See attachment C). The well shall be sufficient depth as may be necessary to penetrate a desirable water bearing stratum and shall produce a continuous yield of **38,000 liters of water per 16 hours period**. Based on the nearby active wells, this stratum is expected to occur at a depth of 150 meters below grade. The contractor shall then connect the new well to the existing water system at the Chancery.

B. Annex Well

The other deep tube water wells will be drilled inside the Annex compound. The Annex compound is located on the East side of Bir Uttam Rafiqul Islam Avenue, one block south of the intersection of Bir Uttam Rafiqul Islam Avenue and Madani Avenue. This water well shall be used to support the future water needs of the Annex and surrounding building. Exact location of the proposed well site can be found in the attached plan drawings (See attachment D). The well shall be sufficient depth as may be necessary to penetrate a desirable water bearing stratum and shall produce a continuous yield of **57,000 liters of water per 16 hours period**. Based on the nearby active wells, this stratum is expected to occur at a depth of 150 meters below grade. The contractor shall then connect the new well to the existing water system at the Chancery

2.0 DESIGN AND TECHNICAL REQUIREMENTS

2.1 GENERAL ARRANGEMENT OF DRAWINGS

The design basis of proposal includes the site plans of both the Chancery and Annex compounds with the exact location of the well sites indicated therein. These drawings can be found in Attachment C and Attachment D.

2.2 SPECIFICATIONS

Specifications are covered in detail in Attachment A and Attachment B. The specifications provide performance and construction requirements for the construction of both wells. The Contractor shall provide a proposal based on these specifications and other attachments to the scope of work referred to herein. Exceptions to the specifications may be considered an alternate proposal and may render the proposal subject to disqualification.

2.3 SUPERVISION OF WORK

The contractor shall provide all supervision necessary to ensure water well construction in accordance with the statement of work.

2.4 PERMITTING

The contractor must obtain all local permits required to construct the well.

2.5 PAYMENT FOR ABORTIVE OR ABANDONED WORK

Refer to the attached specification in Attachment A and Attachment B for payment provisions for aborted or abandoned work.

2.6 PROJECT NOTICE TO PROCEED

The US government shall issue a notice to precede (NTP) will all construction. Notice to proceed shall be issued by the Contracting Officer Representative (COR) authorized by the government. Two NTP's may be issued:

1. NTP with mobilization shall be issued following award.
2. NTP with construction may be issued following completion of mobilization to the work site, upon acceptance of the Contractor's work plan and upon presentation by the contractor of satisfactory insurances to the US government.

2.7 PROJECT MONITORING

The project monitoring of performance of this water well contract provide by the government shall be through the facilities maintenance office, US Embassy, Dhaka, Bangladesh, or their representative delegated for that purpose.

2.8 CONSTRUCTION AND INSTALLATION RECORDS

The contractor shall provide all records required by the attached specifications in Attachment A and Attachment B to the COR. The contractor records shall be completed to the specification of the COR. Additionally, records shall include "as-built" drawing and specifications to the satisfaction of the Project Director for the installed work.

3.0 ATTACHMENTS

Attachment A- Chancery well specification

Attachment B- Annex well specification

Attachment C- Chancery plan drawings

Attachment D- Annex plan drawings

PRICE

The contractor shall provide a firm fixed price proposal for construction of the two water wells at the US Embassy in Dhaka, Bangladesh in accordance with this statement of work and attachments. **Assumed depth** of the well shall be 150 meters from grade at the location provided by OBO. Increased depth providing a constructed length exceeding 150 meters shall be on the basis of unit price for additional depth by 3 meters increments. Contract Line Item (CLIN) 001 below provides for total price of two 150 meters deep tube water wells. Option contract line item 002 below provides unit price of additional depth of well in 3 meters increment. Proposal price shall include all mobilization and demobilization of materials equipments and resources necessary to construct the water well. Contractor's failure to include all related cost shall not be grounds for additional payments. The firm fixed price proposal shall remain open for acceptance by the US government for a period of 45 days following date of proposal. Any extension to acceptance period shall be at the discretion of the government and shall be subject to negotiated equitable price adjustment between the government and contractor.

CLIN 001 construct two 150 meters deep tube water wells in accordance with statement of work and attachment for firm fixed price of US dollars \$.....

CLIN 002 option unit price adjustment for additional depth increment of 3 meters. Firm fixed price of US \$.....per additional 3 meters depth.(or part thereof) to the final set depth of finished well more than the 150 meters basis of CLIN 001.

Basis for additional unit price payment: The basis for additional unit price payment CLIN 002 shall be borehole logs presented by the contractor identifying the set depth of final well construction. Additional payment against CLIN002 shall be calculated.

-End scope of Work-

PART 1 GENERAL

1.1 SCOPE

These specifications inform all interested parties about the equipment and materials needed to successfully complete water well. All works must be completed in accordance with the contract documents. The location shall be in accordance with the contract and approved by the Project Director prior to commencing any work. The water well shall be to such a depth as may be necessary to penetrate a desirable water bearing stratum and produce a continuous yield of **38,000** liters of water per **16** hour period in any given day.

1.2 SITE LOCATIONS

The water bearing stratum is anticipated to be encountered at a depth of 150 meters below ground surface. No water well shall be extended to a depth greater than 200 meters below ground surface.

1.3 REFERENCES

The publication listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

American Society for Testing and Materials (ASTM)

ASTM A 53 Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.

ASTM C 150 Portland cement

American Water Work Association (AWWA)

AWWA-01 Standard method for examination of water and wastewater

AWWA A 100 (1990) Water wells

AWWA B 300 (1992) Hypochlorite's

AWWA C 200 (1991) Steel water pipes-6 inch (150 mm) and larger.

AWWA C 106 (1991) Field welded of steel water pipe.

1.4 MEASUREMENT AND PAYMENT

1.4.1 Water well

Compensation for the water well will be made at the depth stated in the contract and shall include materials, equipment's and labor requires drilling, developing, performing test and completing the water well. Total depth shall be measured as the linear distance between ground surface and bottom of water well screen or bottom of inner casing, whichever is lower. The total depth of the water well shall not be greater than what is stated in the contract unless approved by the Project Director. No payment will be allowed for water wells abandoned due to faulty construction practices or for convenience of the contractor. Payment will be allowed to the contractor for water wells abandoned due to a discontinuous or very low yield. The Project Director will make this determination and instruct the contractor to abandon the water well if required.

1.5 GENERAL REQUIREMENTS

The water well shall be located in accordance with the contract documents and shall be approved by the Project Director in advance of any work. The water well shall be to such a depth as may be necessary to penetrate a desirable water-bearing stratum and produce a continuous yield of 57,000 liters of water per 16 hours period in any given day. The water shall be free of harmful bacteria, chemical and physical substances as established by 40 CFR 141.

1.6 SUBMITTALS

Government approval is requiring for submittal with a “GA” designation; submittals having an “FIO” designation are for information only. The following shall be submitted by contractor:

Work Plan; GA

Proposed plan for constructing water well shall be provided before beginning work. The plan shall include, but not be limited to, the proposed method of drilling and equipment's to be used, details on proposed casing, grouting materials and method and equipment proposed for developing the water well and performing pump test. No work shall be performed until the drilling plan has been approved and no deviation from the approved drilling plan will be permitted without approval of the Project Director. Upon approval of the plan from Project Director the contractor will provide the local user with this plan and coordinate all work through the user. Details of specific method to be employed to control potential contamination or pollution arising from water well installation activities shall also be included.

Tests; FIO

Reports shall be made within 24 hours following the conclusion of each test.

Permits; FIO

A copy of all permits, licenses or other requirements necessary for execution of the work shall be provided by the contractor. Before beginning work, The Project Director shall be noticed of the type and location of water well to be constructed the method of construction and anticipated schedule for construction of the water well. A copy of all such correspondence shall be furnished by the contractor.

Boring Log; FIO

During the drilling of the water well an accurate log shall be maintained. As a minimum, the log shall include depths, elevations and descriptions of all formations encountered. The contractor shall prepare a graphic boring log that shall be used in determining the water well design, screen location and screen opening.

1.7 ENVIRONMENTAL PROTECTION

The contractor shall take all precautions as may be required to prevent contaminated water or water having undesirable physical or chemical characteristics from entering the water supply stratum through the water well bore or by seepage from ground surface. The contractor also shall take all precautions necessary to prevent contamination of the ground surface or of surface waters resulting from the drilling of water well.

1.8 ABANDONED OF WATER WELL

In the event that the contractor fails to construct a water well of the required capacity, or should the water well be abandoned because of loss of tools or for any other cause, the contractor shall fill the abandoned hole in accordance to industry standards. The contractor shall submit an abandoned plan to the Project Director. The Project Director shall approve the plan prior to the contractor performing any work.

1.9 TEST BORING

1.9.0 Description

The work covered under test boring shall consist of transportation, boring of test tube-well, collection of sand and water samples for testing, etc. complete in accordance with these specifications.

1.9.0 CONSTRUCTION REQUIREMENT

- 1.9.1 **Depth:** The scheduled depth of test tube-well may vary according to local condition and shall be determined by consultant, depending on the adequate suitable water bearing strata below the zone for housing (minimum 40 meter)
- 1.9.2 **Diameter:** The diameter test of tube-well shall be **38** mm for the scheduled depth of 200 meter. The diameter of the borehole shall be **50** mm for the scheduled depth.
- 1.9.3 **Discharge:** The test boring work shall be continued till sufficient water bearing strata of found out that is sufficient enough for the discharge of **0.60L/S** of the production well and it shall be finalized by the consultant.

1.10.0 GENERAL INSTRUCTION

- 1.10.1 Due to limitation of size there are **2 (two)** points have been kept one for test tube-well and another for d) days following deep tube-well.
- 1.10.2 The contractor shall submit to the consultants a Programmed which the contractor intends to follow, within **7** (seven the date of the contract.

1.11.0 BOREHOLE DRILLING

- 1.11.1 **Boring for test well:** Boring shall be done for **38** mm dia tube well for the scheduled **200** meter or less depth. The borehole shall be **50** mm dia for the schedule depth of **200** meter. The boring shall be done with suitable equipment manually or water jet method but without use of cow dung.
- 1.11.2 **Installation of Test Tube well pipe:** Supplying and installation of **38** mm dia best quality u-PVC tube well pipe, fitting and u-PVC strainer at portable water bearing strata and collection of water from test tube well for chemical test from Bangladesh University of Engineering and Technology (BUET) all complete as per direction of the Engineer.
- 1.11.3 **Collection of Samples:** The sample of layers of different strata of soil and sand at interval of **3.0** meter shall be collected in **0.5** Kg bags and preserved for sieve analysis of and Bangladesh University of Engineering and Technology (BUET) and representing grain size on neatly drawn log-log graph analysis. Water sample shall be collected in clean airtight bottle for chemical analysis of water of all suitable water bearing strata (of not less than the depth of 40 meter). The stander bottle required for collecting the water sample and the specified bag for soil sample should be the responsibility of the contractor. Before collection of water samples, clean strainer of 3.6 meter length shall be lowered in the strata and continuously pumped till clean water, free from all foreign particles obtained.
- 1.11.4 **Tests:** The contractor shall conduit **Sieve Analysis** of all sand samples including color, grade and proportion of sand-silt-clay mixture if any. Immediately after the collection of water of water samples, the contractor shall also conduit **Chemical Test** of water for its portability (drink ability) including test for arsenic, PH, Nitrate, Bi-carbonate Hardness, iron, Calcium, Manganese and traces of poisonous substance, if any. The contractors at his own shall carry out all tests from Bangladesh University of Engineering Technology (BUET))/Dept. of Public Health Engineering (DPHE) testing laboratory. The test report shall include the design of the production well with maximums discharge of **0.60 L/S**.

1.11.5 Material and Equipment

The contractor shall arrange all drilling pipe, strainer, pumping set and necessary machinery to conduit the test boring work including transportation and supply of all usable materials. All the materials required for construction of production well shall be brand new damage free.

PARTS-2 PRODUCTS

2.1 CASING

The casing shall be of sufficient size for the maximum yield as specified. All casing, screen and other water well materials shall be of compatible materials to prevent galvanic reaction between components of the completed water well.

2.1.1 Steel casing and coupling

Steel casing shall be the standard weight black steel pipes, conforming to ASTM A 53, or steel pipes conforming to AWWA C200, as applicable. Joint shall be either threaded or coupled, or field welded in accordance with AWWA C206. All casing shall be provided with drives shoes.

2.1.2 Inner casing

The inner casing shall have a minimum of **150** mm inside dia meter and shall be constructed of the same materials as the outer casing and the water well screen. The inner casing shall be connected directly to the top of the water well screen by an approved method.

2.2 WATERWELL SCREENS

Water well screen shall be minimum of **150** mm nominal diameter, and shall be directly connected to the bottom of the inner casing by an approved method. The screen shall be sufficient length and shall provide an intake area capable of passing not less than the minimum required yield of the water well at an entrance velocity not greater than 3.05 centimeter per second. The opening size shall be compatible with the materials surrounding the screen and shall be submitted for approval prior to installation. The water well screen shall be of sufficient size and design to hold back and support the in-situ materials surrounding the screen. The screen and all accessories required for satisfactory operation shall be essentially standard product of reliable manufacturers regularly engaged in the production of such equipment. A field constructed screen is not acceptable. "Blank" in the water well screen may be utilized in nonproductive zones and shall be considered "casing".

2.2.1 Metal Screen

Metal screen shall be of an approved wire-wound type with wire not less than No. 7 AWG and the supporting bars not less than 6.36 mm thickness. Both wire and supporting bars shall be type 304 stainless steel, conforming to the applicable requirements of AWWA A100. If a pipe core is used, it shall be at least schedule 10 pipe and shall be of the same material as the wire. A wire-wound screen manufactured with supporting bars or core of material different from the wire will not be acceptable. Joints shall be made of threaded couplings of the same material as the screens or by brazing or welding in accordance with AWWA C206.

2.3 CEMENT GROUT

Cement grout shall consist of Portland cement conforming to ASTM C 150, Type I or II, sand and water. Cement grout shall be proportioned not to exceed 9 liters of water per 0.3 cubic meters of cement, with a mixture of such consistency that the water well can be properly grouted. Not more than 3 percent by weight of bentonite powder may be added to reduce shrinkage.

PART-3 EXECUTIONS

3.1 WATER WELL CONSTRUCTION

3.1.1 General Requirements

The method of drilling shall be as approved by the Project Director and shall conform to all industry and local standards for well construction. The execution of the work shall be by competent workmen and performed under the direct supervision an experienced well driller. Casing pipe, well screens, and joint couplings shall be of compatible materials throughout each water well. The water well shall be drilled straight, plumb, and circular from top to bottom. The water well shall be initially drilled form the ground surface to the bottom of the outer casing. The hole below the outer casing shall fully penetrate the water bearing stratum a sufficient depth to produce the required amount of water without causing excessive velocities through the aquifer.

3.1.2 Setting Outer Casing

The outer casing shall not be less than 200 mm in diameter. The hole shall be of sufficient size to leave a concentric annular space of not less than 64 mm between the outside of the outer casing and the walls of the hole. The annular space between the outer casing and the walls of the hole shall be filled with cement grout. Acceptable methods of grouting are detailed in AWWA A100. No method will be approved that does not specify the forcing of grout from the bottom of the space to be grouted towards the surface. A suitable grout retainer, packer, or plug shall be provided at the bottom of the outer casing so that grout will not leak into the bottom of the water well. Grouting shall be done continuously in such a manner as will ensure that the entire annular space is filled in one operation. After grouting is completed, drilling operation shall not be resumed for at least 72 hours to allow proper setting of the grout. The top of the outer casing shall be a minimum 0.6 m above existing ground surface and extend to minimum depth of 7.6 m below existing grad.

3.1.3 Construction of inner Casing and Screen

After the grout has set, the hole below the outer casing shall be under reamed at the required diameter to the required depth by an approved method which will prevent caving of the hole before or during installation of the water well screen and inner casing. The water well screen and inner casing shall be lowered into the hole by a method which will allow for control of the rate of fall of the water well screen and inner casing at all times. Water well screen and inner casing shall not be dropped or allowed to fall uncontrolled into the hole. The inner casing shall extend up through the outer casing to a height of 0.6 m above existing ground surface. Approved centering devices shall be installed at a spacing of 120 degrees between the outer casing and inner casing prior to water construction at intervals not exceeding 3 m.

3.1.4 Placing packer

After the inner casing and water well screen have been installed, the annular space between the inner and outer casing shall be sealed by use of an approved packer.

3.2 INSTALLATION OF TUBEWELLS

- 3.2.1 **General:** The contractor shall be responsible for installation of deep tube well. The actual length of strainer and blind pipe and housing pipes to be installed shall be determined by the consultant on the basis of results obtained from test tube-well.
- 3.2.2 **Housing pipe:** Pump housing pipe shall be assembled by field welding preferably by using fixture to keep the joint's straight. The ends of the casing sections shall be leveled and cleaned, as per standard practice for welding and butt shapes shall be provided. All fields welding shall be performed by the electric arc method after being deposited in 2 or 3 layers and each layer of welding shall be cleaned of slag and shall show uniform sections of smoothness of weld metal. The housing pipe shall be connected to the blind pipe by means of reducing socket.
- 3.2.3 **Strainer:** The length of strainer to be installed in water bearing stratum and the depth at which they will be installed shall be determined as per design done on the basis of the results obtained from the test tube well.
- 3.2.4 **Blind pipe:** The length of blind pipe to be installed shall be decided on the basis of well design. Blind pipe shall be installed using screwed joints.
- 3.2.5 **Bail plug:** The bottom of the tube well casing shall be provided with a bail plug having a length of 3 meter including blind pipe.

3.3 WATER WELL DEVELOPMENT

After construction, the water well shall be developed in accordance with the drilling plan. The Contractor shall develop the water well by such methods approved until the water pumped from the water well is substantially free sand. Developing equipment shall be of approved type and of sufficient capacity to remove all cutting fluids, sand, rock cutting, and any other foreign material. The water well shall be thoroughly cleaned from top to bottom before beginning the water well tests.

3.4 TESTS

During construction of the water well, whenever sufficient water is found to indicate that a water well of required capacity may be developed, or when directed, a capacity test shall be performed. If the capacity test indicates that the required capacity can be obtained, the tests for quality of water shall be made. If the capacity and quality tests indicate that the required capacity and quality can be obtained the water well shall be completed at that depth. Prior to making quality test, drilling equipment, tools and pumps contacting water well water shall be cleaned with live steam.

3.4.1 Capacity Test

The contractor shall furnish and install an approved temporary test pump, with discharge piping of sufficient size and length to conduct the water being pumped to point of discharge, and equipment necessary for measuring the rate of flow and water level in the water well. A continuous 12 hours capacity test shall be run with the pumping rate and drawdown at the water well and recorded every ½ minute during the first 5 minutes after starting the pump; then every 5 minutes for an hour; then every 20 minutes for 2 hours. From this point on, readings taken at hourly intervals are sufficient. No observation wells are available therefore all water levels must be taken in the water well being tested to determine drawdown depths. The test shall begin at the rate of the expected capacity of water well and at least that rate maintained throughout the duration of the test. If this capacity cannot be maintained for the test period, the contractor will terminate the capacity test and notify the Project Director for direction.

3.4.2 Test for Plumpness and Alignment

No plumpness and alignment tests are necessary; however, should the faulty alignment and plumpness not as specified in paragraph 1.8 ABANDONMENT OF WATER WELL and new water well be drilled at no additional cost to the Government.

3.4.3 Test for quality of Water

When the drawdown or capacity tests have been completed, the Contractor shall secure samples of water in the suitable containers and of sufficient quantity to have bacterial, physical, and chemical analyses made by a certified testing laboratory. Tests shall address each item specified in the Water Quality Analysis Table at the end of this section. Expenses related to these analyses shall be borne by the Contractor and the results of the analyses shall be furnished to the Project Director. All sampling and analyses shall be performed using EPA approved methods, procedures, and holding times.

3.5 DISINFECTING

After completion of water well, or at the time of the yield and drawdown test, whichever is later, the water well shall be disinfected by adding chlorine, conforming to AWWA B301, or hypochlorite, conforming to AWWA B300, in sufficient quantity that a concentration of at least 50 ppm chlorine shall be attained in all parts of the water well. Chlorine solution shall be prepared and introduced into the water well in an approved manner and shall remain in the water well for a period of at least 12 hours. Disinfection of water well shall be in accordance with any method described in Section A1 thru A 10 of AWWA A100. After the contact period, the water well shall be pumped until the residual chlorine content is not greater than 1.0 ppm. The water well shall be disinfected and re- disinfected as may be required until two consecutive samples of water are found upon testing to be free from the Coli Acrogens group of organisms.

3.6 CAPPING THE WATER WELL

During construction and completion, the Contractor shall use all reasonable measures to prevent the entrance of foreign matter into the water well. The Contractor shall be held responsible for any objectionable material that may fall into the water well and any effect it may have on the water quality of the water well. Upon completion of the water well, **if the installation of pump is not done immediately**, the Contractor shall install a suitable screwed, flanged, or welded cap to prevent any pollutants from entering the water well.

3.7 CLEAN-UP

Upon completion of the water well's construction and other incidentals, all debris and surplus materials resulting from the work shall be removed from the jobsite. All drill cutting shall be spread evenly on the ground surface and all water generated while drilling or performing testing shall be properly routed under guidance from the Project Director.

WATER QUALITY ANALYSIS TABLE

Characteristics

Physical

Color
Taste
Threshold odd number
 p^H
Temperature
Turbidity

Chemical (Expressed as mg/l)

Arsenic
Total hardness as $CaCO_3$
Barium
Endrin
Cadmium
Lindane
Chromium
Methoxychlor
Copper
Toxaphene
Lead
2-4-D
Mercury
2,4,5 TP silvex
Selenium
Total Organic Halogens
Silver
Total Organic Compounds(TOC)
Fluoride
Manganese (Dissolved and total)
Iron as Fe (Dissolved and total)
Suspended solids
Total Dissolved Solids
Calcium
Magnesium
Sodium and potassium as Na Sulphates as SO_4
Chlorides
Bicarbonates as HCO_3
Carbonest as CO_3
Nitrates
Alkalinity as $CaCO_3$
Silica as SiO_2

3.8.0 INSTALLATION OF SUBMERSIBLE PUMP

3.8.1 General

The Contractor shall supply, install test and commission the submersible pump as specified in the tender schedule. The pump shall be completely factory assembled with submersible motor, built in flap type non-return valve, base plate, discharge elbow, mounting clamp etc.

The submersible pump shall be vertical spindle, fixed pitch, multistage, rod dynamic, and mixed flow type impeller which from a compact unit in conjunction which the submersible motors suitable for vertical installation.

The submersible pump set shall be capable of circulating water not less than **40litre/min discharge (flow rate) against the total head of 150 meter**. The pump shall be suitable for installation and operation in tube well within inner casing of **150mm** diameter.

3.8.2 Pump Assembly

The pump shall have separate section for each stage bolted together with matching face accurately machined and spigot to ensure and alignment. The waterway of the pump body and intermediate bowl shall be smooth and free from surface defects.

Each pump assembly shall consist of a suction case intermediate bowls and a bearing case wherein the pump rotor shall be mounted. The suction case shall be provided with perforated strainer of stainless steel sheet. The suction case, intermediate bowls and bearing case shall be malleable steel.

Each suction case and bearing case shall be fitted with lead-tin bronze/Al-bronze bearing. A sand guard of bronze shall also be provided to protect the bearing.

3.8.3 Impeller

The impeller shall be bronze, enclosed type, statically and dynamically blanked and securely fastened to the pump shaft by key. The waterway of the impellers shall be smoothly finished.

3.8.4 Shaft Sleeve and Non-return Valve

The pump shaft shall be stainless steel, ground, polished and provided with key slots. A sleeve coupling of stainless steel connecting the motor shaft to the pump shaft shall be located within the suction casing.

The pump shall be provided with built-in non-return valve at the discharge end having flanged connection to receive the rising pipe.

3.8.5 Submersible Motor

The submersible motor shall be of wet type, water filled. Water-cooled and water lubricated, squirrel cage induction motor. The water shall lubricate the bearing and cool the waterproof insulated winding. The submersible motor shall be specially designed to operate in wide voltage fluctuation range between **380V to 440V**.

Stator of the submersible motor shall be impregnated in special waterproof varnish and the stator assembly shall be covered with special PVC insulation. The winding wire/cable shall be specially insulated by 100% waterproof special PVC insulation.

The axial thrust generated by the pump shall be absorbed by a Mitchell tilting pad thrust bearing located at the bottom end of the motor. The motor shaft shall be sealed by radial seal rings (oil seal) to avoid any exchange between the motor fill water and the water in the well.

A pressure-compensating diaphragm shall be provided the thrust bearing to compensate the rise of pressure resulting from the expansion of the volume of water filled in the motor caused by the heat generated in the winding.

The cable shall be led out of the motor through cable seating glands and protected against mechanical damage by enable guard strips along with the length of the pump.

3.8.6 Cable

Waterproof 3 core cable of required x- sectional area shall be provided with sufficient length to connect the motor and the starter/ electric panel board in the specified place. The cable shall be of copper wire and special PVC insulated and sheathed for 600/11000-Volt grade. The cable shall be clamped to the rising pipe by means of cable clamps placed at every 3 meter intervals at the time of installation. The cable shall be connected to the cable of the motor by means of water tight cable connectors.

3.8.7 Rising Pipe

The rising pipe shall be furnished in interchangeable sections having nominal length of 3 meter. Each rising pipe shall be of M. S. Pipe having both ends flanged especially provided with groove for cable pass, so that any mechanical damage of the cable may not occur during installation.

3.8.8 Head Plate

The steelhead plate shall be of sufficient thickness of ample strength and fitted with a 90-deg. Steel bend. The bend shall be provided with a lifting lug and boss for fitting pressure gauge. A vent hole and vent pipe shall be fitted on the head plate to break the vacuum caused during pumping of water from the well. It is also provided with an arrangement for anchoring to foundation, so that any foreign materials not drop/enter in to the well.

3.8.9 Starting

The starting equipment shall be provided with push button type automatic star-delta starter equipped with protection against over load and locked motor condition.

3.8.10 Painting

The bowl assembly and the rising pipe shall be painted with anti-corrosive paint and thereafter with black paint

**BILL OF QUANTITY FOR CONSTRUCTION AND COMMISSIONING OF
WATER WELL AT CHANCERY COMPOUND
US EMBASSY, BARIDHARA, DHAKA.**

SECTION 01 : ITEMS FOR TUBE WELL INSTALLATION AND COMMISSIONING

Item No.	Brief Description of Works	Unit	Qty	Rate (Taka)	Total Amount (Taka)
1	2	3	4	5	6 = 4 x 5
2	Production Well Drilling & Construction:				
2.1	Mobilization : Preparation, transportation and mobilization of complete drilling equipment and plants, construction components to the work site and demobilization, re-transportation, clearing the site after completion of work, etc. All complete as per specification and direction of the Contract Officer Representative (COR).	L.S.	1		
2.2	Drilling of Production Bore Hole : Execution of production well boring by reverse circulation or rotary method as per specification and direction of the Engineer. The dia of bore hole shall be minimum 400mm .				
2.2.1	From 0 m to 50 m	Rm	50		
2.2.2	From 50 m to 100 m	Rm	50		
2.2.3	From 100 m to 165 m	Rm	65		

Item No.	Brief Description of Works	Unit	Qty	Rate (Taka)	Total Amount (Taka)
1	2	3	4	5	6 = 4 x 5
2.3	Installation of Well Components : Supplying and installation of the following Tube Well fixtures at working site as per standard practice and direction of the Contract Officer Representative (COR).				
2.3.1	Outer Casing/ Housing Pipe shall be 300 mm nominal dia and shall be standard weight black steel pipe, conforming ASTM A 53 or steel pipe conforming to AWWA C 200 . Joint shall be both threaded and coupled or field welded in accordance with AWWA C 206 . All casing shall be provided with drive shoes. All complete as per specification and direction of the Contract Officer Representative (COR).	Rm	15		
2.3.2	300 mm dia M.S. cap having 6mm thickness for housing pipe covering.	Each	1		
2.3.3	Inner Casing/ Blind Pipe shall be 150 mm nominal dia and shall be standard weight black steel pipe, conforming ASTM A 53 or steel pipe conforming to AWWA C 200 . Joint shall be either threaded or coupled or field welded in accordance with AWWA C 206 . All casing shall be provided with drive shoes. All complete as per specification and direction of the Contract Officer Representative (COR).	Rm	150		
2.3.4	Strainer shall be 150 mm nominal dia and shall be standard weight black steel pipe, conforming ASTM A 53 or steel pipe conforming to AWWA C 200 . Joint shall be either threaded or coupled or field welded in accordance with AWWA C 206 . All casing shall be provided with drive shoes. All complete as per specification and direction of the Contracting Officer Representative (COR). Thickness of pipe 4.8 mm(minimum), Opening area limited to 15% to 22%, Width of slot 0.4mm/400micron (Maximum)	Rm	15		
2.3.6	Centralizer made of 3 mm dia M.S. rod fixed at an interval as specified.	Each	150		

Item No.	Brief Description of Works	Unit	Qty	Rate (Taka)	Total Amount (Taka)
1	2	3	4	5	6 = 4 x 5
2.3.7	150 mm dia G.I. bail plug	Rm	5		
2.3.8	150 mm dia and 6mm thick M.S. cap for blind pipe /sand trap .	Each	1		
2.4	Production Well Installation and Testing :				
2.4.1	Installation of Tube well Complete installation of 150 mm dia deep tube well fixtures such as expanded top pipes, housing pipes, strainer, blind pipe, pipe cap etc. with fitting & fixing, welding and placing in position etc. All complete as per standard practice and direction of the Contract Officer Representative (COR) including supply of all necessary materials and equipment in the field.	Rm	165		
2.4.2	Verticality and Alignment Test : Checking of verticality and straightness of well casing by provided the required equipment as per specification and direction of the Contract Officer Representative (COR).	L.S	1		
2.4.3	Gravel Shrouding: Preparation and making gravel pack around the tube well fixtures with supply of designed graded pea gravels free from any substance harmful to pipe and health confirmed by test (Passing through 10 mesh and retained on 40 mesh) including sieving, washing etc. All complete as per direction of the Contracting Officer Representative (COR)	cum	14		
2.4.4	Cement Grouting Grout shall consist of Portland cement conforming to ASTM C 150, Type I or II, sand and water. Grout shall be proportioned not to exceed 9 liters of water per 0.3 cubic meters of cement, with a mixture of such consistency that the water well can be properly grouted. Not more than 3 percent by weight of bentonite powder may be added to reduce shrinkage.	cum	1.5		

Item No.	Brief Description of Works	Unit	Qty	Rate (Taka)	Total Amount (Taka)
1	2	3	4	5	6 = 4 x 5
2.4.5	Development the Well: After construction, the water well shall be developed in accordance with the drilling plan. The Contractor shall develop the water well by such methods approved until the water pumped from the water well is substantially free sand. Developing equipment shall be of approved type and of sufficient capacity to remove all cutting fluids, sand, rock cutting, and any other foreign material. The water well shall be thoroughly cleaned from top to bottom before beginning the water well tests. All complete as per standard practice and direction of the Contract Officer Representative (COR).	LS	1		
2.4.6	Capacity Test : The contractor shall furnish and install an approved temporary test pump, with discharge piping of sufficient size and length to conduct the water being pumped to point of discharge, and equipment necessary for measuring the rate of flow and water level in the water well. A continuous 12 hours capacity test shall be run with the pumping rate and drawdown at the water well and recorded every ½ minute during the first 5 minutes after starting the pump; then every 5 minutes for an hour; then every 20 minutes for 2 hours. From this point on, readings taken at hourly intervals are sufficient. No observation wells are available therefore all water levels must be taken in the water well being tested to determine drawdown depths. The test shall begin at the rate of the expected capacity of water well and at least that rate maintained throughout the duration of the test. If this capacity cannot be maintained for the test period, the contractor will terminate the capacity test and notify the Contract Officer Representative (COR) for direction.	LS	1		

Item No.	Brief Description of Works	Unit	Qty	Rate (Taka)	Total Amount (Taka)
1	2	3	4	5	6 = 4 x 5
2.4.7	Test for Quality of Water: When the drawdown or capacity tests have been completed, the Contractor shall secure samples of water in the suitable containers and of sufficient quantity to have bacterial analyses made by a certified testing laboratory. Tests shall address each item specified in the Water Quality Analysis Table at the end of general technical specification. Expenses related to these analyses shall be borne by the Contractor and the results of the analyses shall be furnished to the Contract Officer Representative (COR).	L.S.	1		
2.4.8	Disinfection of the well: After completion of water well, or at the time of the yield and drawdown test, whichever is later, the water well shall be disinfected by adding chlorine, conforming to AWWA B301, or hypochlorite, conforming to AWWA B300, in sufficient quantity that a concentration of at least 50 ppm chlorine shall be attained in all parts of the water well. Chlorine solution shall be prepared and introduced into the water well in an approved manner and shall remain in the water well for a period of at least 12 hours. Disinfection of water well shall be in accordance with any method described in Section A1 thru A 10 of AWWA A100. After the contact period, the water well shall be pumped until the residual chlorine content is not greater than 1.0 ppm. The water well shall be disinfected and re- disinfected as may be required until two consecutive samples of water are found upon testing to be free from the Coli Acrogens group of organisms.	L.S.	1		

Item No.	Brief Description of Works	Unit	Qty	Rate (Taka)	Total Amount (Taka)
1	2	3	4	5	6 = 4 x 5
3	Submersible Pump : Supply, installation, testing and commissioning of complete set of submersible pump for tube well of following capacity. The pump shall be water lubricated and shall be complete with all necessary accessories including motor, control/starter panel made of 16 SWG (1.6mm) sheet steel, circuit breaker, star-delta starter, protective devices, etc. The pump shall be supplies as per specification and installed as per direction of the Contract Officer Representative (COR). Type : Submersible for deep well Discharge : 1.0 lit/sec Pump size : 4.0 Hp Efficiency : 65% (minimum) Cable size : 4.00 sqmm, 1x3core Flat type Cable size : 1c-4x10.00 sqmm NYY From substation to pump room (BRB or Eastern cables) Power : 415 V, 50Hz, 3ph. Starting method : DOL Nominal speed : 2900 rpm NRV (Delivery Dia) : 100 mm DB Box : 60 amps (with TP,SP MCB & TPN BUSBAR) Column Pipe : 80 meter	Set	1		
4	Sluice Valve and Non-Return Valve: Supply, installation, testing and commissioning of sluice valve and Non-return Valve at the outlet of well discharge including necessary materials.				
4.1	100 mm dia sluice valve	Each	1		
4.2	100 mm dia non-return valve	Each	1		
			Sub Total (Tk)		

SECTION 02 : ELECTRICAL WORKS

Item No.	Brief Description of Works	Unit	Qty	Rate (Taka)	Total Amount (Taka)
1	2	3	4	5	6 = 4 x 5
1	Wiring: (1) Concealed conduit wiring of the following points looping at the switch board with earth terminal including circuit wiring with 1c-2x1.5 sqmm and 1c-2x2.5 sqmm insulated sheathed standard cable (BYA) & 1.5 sqmm PVC insulated green/ white colored EEC wire (BYA) through PVC conduit of 25/20 mm dia, 1.5mm wall thickness. 18 SWG GP sheet switch board and pull box, 3mm ebonite sheet cover etc including mending good the damages. Conduit: Modern, Lira or Equivalent				
	a). Light point	Each	1		
	b). 2-Pin 5 Amp socket	Each	1		
	(2) Concealed conduit wiring with following PVC insulated and standard cable (BYA) & insulated green/ white colored EEC wire (BYA) through PVC conduit. Complete with 18 SWG GP switch and pull box, 3mm thick ebonite sheet cover etc including mending good the damages. Conduit: Modern, Lira or Equivalent				
	a). 1C-2x2.5 sqmm BYA cable, 2.5 sqmm BYA EEC wire through pipe of inner dia 20 mm having wall thickness of 1.5mm.	Rm	20		
	b). 1C-2x4 sqmm BYA cable, 4 sqmm BYA EEC wire through pipe of inner dia 20 mm having wall thickness of 1.5mm.	Rm	20		
2	Light Fitting: Provide and fix 1-40 watt rod bulb in wall. Complete with bulb holder, shed, cover and other accessories. Brand: Philips or Equivalent.	Each	1		

Item No.	Brief Description of Works	Unit	Qty	Rate (Taka)	Total Amount (Taka)
1	2	3	4	5	6 = 4 x 5
3	2-Pin Socket Out-let: Provide and fix 2-pin, 5 Amp, 250 Volt socket outlet with control switch, piano type local made, circuit connection to switch board and other accessories etc. All complete as per direction of the Project Director.	Each	1		
4	MK Gang Switch: Supply and fix best quality MK switch including circuit connection to switch board and all other accessories. All complete as per direction of the Project Director.				
	a). 1-Gang switch	Each	1		
	b). 2-Gang switch	Each	1		
			Sub-Total (Tk.)		

SUMMARY OF COST

Grand Total (Tk.) = Section-01 + Section-02 =

In word (Taka)

Signature of Bidder

Seal & Address of Bidder

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